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Claims

1. An optical object investigation device, comprising a
microscope having an object area (64), in which an
5 object (72) to be investigated may be placed, an
observation beam path (62), which leads from the
object area to an image area (66), and at least one
illumination beam path (80, 82, 100) connected to a
light input (84, 86, 102), by means of which
10 illumination beam path the object area may be
illuminated, and comprising an illuminator (10) having
a light source (12), which illuminator is connected or
may be connected to the light input with a light
output (34 or 34-1 or 34-2),

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characterised in that

the illuminator comprises optical components (16-1,
18-1, 20-1, 16-2, 18-2, 20-2), which define a
20 plurality of light paths (14-1, 14-2; 14-1, 14-2, 14-
3) originating from the light source;

in at least one of the light paths there is arranged a
light conditioning arrangement (22-1 or 22-2 or 22-3
25 respectively), in order to supply the microscope with
conditioned light via the light output;

the illuminator comprises at least one light path selector unit (24; 24, 25), which comprises a plurality of input light path portions assigned in each case to a different one of the light paths and at least one output light path portion leading to the light output or to an assigned one of a plurality of light outputs of the illuminator;

a control unit controlling the light path selector unit is provided, by means of which the light path selector unit may selectively be adjusted between a plurality of selector states in such a way that, when the light path selector unit is in an appropriate selector state, each of the light paths may selectively be connected as selected light path via the output light path portion to the light output or via a predetermined or selected output light path portion to a predetermined or selected light output, in order to supply the microscope with light or conditioned light from the selected light path;

the control unit is designed to adjust the light path selector unit (24; 24, 25) in a selected time sequence in accordance with a predeterminable selection program in a defined manner between its selector states and to provide defined adjustment times for adjusting the light path selector unit between its selector states; and

the light path selector unit (24) comprises at least one optical light deflector element (26) adjustable between a plurality of selection positions, wherein each selector state may be achieved on the basis of at

least one selection position of the light deflector element, light which is incident via the assigned selected light path being diverted in the respective selector state into the output light path portion or
5 into the predetermined or selected output light path portion and light which is incident via the or a respective non-selected light path not being diverted into the or into any output light path portion.

10 2. An object investigation device according to claim 1, characterised in that the light path selector unit (24; 24, 25) may be adjusted into at least one selector state in which no light path is selected, such that none of the light paths is connected to the
15 or a light output.

3. An object investigation device according to claim 1 or 2, characterised in that the light path selector unit (24) comprises at least one mirror (26) arranged to be
20 swivellable or rotatable by means of an actuator (28).

4. An object investigation device according to claim 3, characterised in that the actuator takes the form of a galvanometer (28).
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5. An object investigation device according to any one of claims 1 to 4, characterised in that the light path selector unit comprises at least one micromechanical adjusting mirror arrangement with a plurality of
30 micromechanical adjusting mirrors, which may be controlled electrically in order to adjust the adjusting mirrors or selected ones of the adjusting mirrors between a plurality of selection positions.

6. An object investigation device according to claim 5,
characterised in that the adjusting mirrors take the
form of swivel mirrors.
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7. An object investigation device according to any one of
claims 1 to 6, characterised in that the light
conditioning arrangement (22-1, 22-2; 22-1, 22-2, 22-
3) comprises an optical wavelength selection
10 arrangement, by means of which at least one
predetermined or settable selection wavelength,
preferably precisely one predetermined or settable
selection wavelength, may be selected with a
predetermined or settable selection bandwidth for
15 propagation in the direction of the light path
selector unit (24 or 25).
8. An object investigation device according to claim 7,
characterised in that in each of the light paths (14-
20 1, 14-2; 14-1, 14-2, 14-3) there is provided a light
conditioning arrangement (22-1, 22-2; 22-1, 22-2, 22-
3) comprising a respective wavelength selection
arrangement, by means of which light conditioning
arrangement selection wavelengths differing with
25 regard to light path may be selected for propagation
in the direction of the light path selector unit.
9. An object investigation device according to any one of
claims 1 to 8, characterised in that the light
30 conditioning arrangement comprises an optical
polariser arrangement.

10. An object investigation device according to any one of claims 1 to 9, characterised in that the light conditioning arrangement comprises an adjustable optical intensity attenuating arrangement or beam shading arrangement (50) for setting an output intensity at the light output.
11. An object investigation device according to any one of claims 1 to 10, characterised by at least one light trap (36) assigned to the light path selector unit, to which light trap a non-selected light path may be connected via the light path selector unit, and/or by an optical shutter arrangement in at least one of the light paths or light path portions.
12. An object investigation device according to any one of claims 1 to 11, characterised in that precisely one light output (34) is provided, to which precisely one selected one of the light paths may preferably be connected by means of the light path selector unit.
13. An object investigation device according to any one of claims 1 to 11, characterised in that at least two light outputs (34-1, 34-2) are provided, and in that at least two selected light paths may be simultaneously connected to a respective one of the light outputs by means of the light path selector unit or by means of at least two separate light path selector units (24, 25).
14. An object investigation device according to any one of claims 1 to 13, characterised in that at least two light path selector units (24, 25) may be adjusted

into mutually assigned selector states, in such a way that a selected one of the light paths is connected via these light path selector units to the light output or a predetermined or selected light output.

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15. An object investigation device according to any one of claims 1 to 14, characterised in that more than two light paths (14-1, 14-2, 14-2) are provided.

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16. An object investigation device according to any one of claims 1 to 15, characterised in that reflective components (18-1, 20-1, 18-2, 20-2) and/or refractive components (16-1, 16-2) and/or diffractive components are provided as the optical components defining light paths.

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17. An object investigation device according to any one of claims 1 to 16, characterised in that mirrors (18-1, 20-1, 18-2, 20-2) and/or lenses (16-1, 16-2) and/or diaphragms are provided as the optical components defining light paths.

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18. An object investigation device according to any one of claims 1 to 17, characterised in that the light paths take the form, at least between the light source and the light path selector unit, of free radiation light paths (14-1, 14-2; 14-1, 14-2, 14-3) which are not bound to a medium which defines the light path.

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19. An object investigation device according to any one of claims 1 to 18, characterised in that the light output or the light outputs are formed on the basis of a (respective) light guide (34; 34-1, 34-2).

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20. An object investigation device according to any one of claims 1 to 19, characterised in that the control unit controls the light conditioning arrangement or light conditioning arrangements.
21. An object investigation device according to any one of claims 1 to 20, characterised in that it comprises at least one incident-light illumination beam path, preferably at least two incident-light illumination beam paths (80, 82), which optionally coincide(s) at least in part with the observation beam path (62).
22. An object investigation device according to any one of claims 1 to 21, characterised in that it comprises at least one transmitted-light illumination beam path (100).
23. An object investigation device according to any one of claims 1 to 22, characterised in that it comprises at least two, preferably at least three illumination beam paths (80, 82, 100), which may be supplied alternately or - preferably - simultaneously with illumination light from the illuminator (10).
24. An object investigation device according to any one of claims 1 to 23, characterised in that it comprises a fluorescence measuring device (60) comprising the object area (64), the observation beam path (62) and the at least one illumination beam path (80, 82, 100) and including the microscope.

25. An illuminator for an optical object investigation device, which comprises a microscope having an object area (64), in which an object (72) to be investigated may be placed, an observation beam path (62), which
5 leads from the object area to an image area (66), and at least one illumination beam path (80, 82, 100) connected to a light input (84, 86, 102), by means of which illumination beam path the object area may be illuminated, in particular for an optical object
10 investigation device according to claim 1, comprising:
- a light source (12);
 - optical components (16-1, 18-1, 20-1, 16-2, 18-2,
15 20-2), which define a plurality of light paths (14-1, 14-2; 14-1, 14-2, 14-3) originating from the light source;
 - a light conditioning arrangement (22-1 or 22-2 or
20 22-3 respectively) in at least one of the light paths,
 - at least one light output (34; 34-1, 34-2), to
25 which the microscope (40; 60) to be supplied with light or conditioned light is connected or may be connected;
 - at least one light path selector unit (24; 24,
30 25), which comprises a plurality of input light path portions assigned in each case to a different one of the light paths and at least one output light path portion leading to the light

output or to an assigned one of the light outputs;

5 - a control unit controlling the light path
selector unit, by means of which the light path
selector unit may selectively be adjusted between
a plurality of selector states, in such a way
that, when the light path selector unit is in an
appropriate selector state, each of the light
10 paths may selectively be connected as selected
light path via the output light path portion to
the light output or via a predetermined or
selected output light path portion to a
predetermined or selected light output, in order
15 to supply the microscope with light or
conditioned light from the selected light path,

wherein the control unit is designed to adjust
the light path selector unit (24; 24, 25) in a
20 selected time sequence in accordance with a
predeterminable selection program in a defined
manner between its selector states and to provide
defined adjustment times for adjusting the light
path selector unit between its selector states;
25 and

wherein the light path selector unit (24)
comprises at least one optical light deflector
element (26) adjustable between a plurality of
30 selection positions, wherein each selector state
may be achieved on the basis of at least one
selection position of the light deflector
element, light which is incident via the assigned

selected light path being diverted in the
respective selector state into the output light
path portion or into the predetermined or
selected output light path portion and light
5 which is incident via the or a respective non-
selected light path not being diverted into the
or into any output light path portion.

26. An illuminator according to claim 25, characterised in
10 that the light path selector unit (24; 24, 25) may be
adjusted into at least one selector state in which no
light path is selected, such that none of the light
paths is connected to the or a light output.

15 27. An illuminator according to claim 25 or 26,
characterised in that the light path selector unit
(24) comprises at least one mirror (26) arranged to be
swivellable or rotatable by means of an actuator (28).

20 28. An illuminator according to claim 27, characterised in
that the actuator takes the form of a galvanometer
(28).

25 29. An illuminator according to any one of claims 25 to
28, characterised in that the light path selector unit
comprises at least one micromechanical adjusting
mirror arrangement with a plurality of micromechanical
adjusting mirrors, which may be controlled
electrically in order to adjust the adjusting mirrors
30 or selected ones of the adjusting mirrors between a
plurality of selection positions.

30. An illuminator according to claim 29, characterised in that the adjusting mirrors take the form of swivel mirrors.
- 5 31. An illuminator according to any one of claims 25 to 30, characterised in that the light conditioning arrangement (22-1, 22-2; 22-1, 22-2, 22-3) comprises an optical wavelength selection arrangement, by means of which at least one predetermined or settable
10 selection wavelength, preferably precisely one predetermined or settable selection wavelength, may be selected with a predetermined or settable selection bandwidth for propagation in the direction of the light path selector unit (24 or 25).
- 15 32. An illuminator according to claim 31, characterised in that in each of the light paths (14-1, 14-2; 14-1, 14-2, 14-3) there is provided a light conditioning arrangement (22-1, 22-2; 22-1, 22-2, 22-3) comprising
20 a respective wavelength selection arrangement, by means of which light conditioning arrangement selection wavelengths differing with regard to light path may be selected for propagation in the direction of the light path selector unit.
- 25 33. An illuminator according to any one of claims 25 to 33, characterised in that the light conditioning arrangement comprises an optical polariser arrangement.
- 30 34. An illuminator according to any one of claims 25 to 33, characterised in that the light conditioning arrangement comprises an adjustable optical intensity

attenuating arrangement or beam shading arrangement (50) for setting an output intensity at the light output.

- 5 35. An illuminator according to any one of claims 25 to 34, characterised by at least one light trap (36) assigned to the light path selector unit, to which light trap a non-selected light path may be connected via the light path selector unit and/or by an optical shutter arrangement in at least one of the light paths or light path portions.
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36. An illuminator according to any one of claims 25 to 35, characterised in that precisely one light output (34) is provided, to which precisely one selected one of the light paths may preferably be connected by means of the light path selector unit.
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37. An illuminator according to any one of claims 25 to 35, characterised in that at least two light outputs (34-1, 34-2) are provided, and in that at least two selected light paths may be simultaneously connected to a respective one of the light outputs by means of the light path selector unit or by means of at least two separate light path selector units (24, 25).
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38. An illuminator according to any one of claims 25 to 37, characterised in that at least two light path selector units (24, 25) may be adjusted into mutually assigned selector states, in such a way that a selected one of the light paths is connected via these light path selector units to the light output or a predetermined or selected light output.
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39. An illuminator according to any one of claims 25 to 38, characterised in that more than two light paths (14-1, 14-2, 14-2) are provided.
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40. An illuminator according to any one of claims 25 to 39, characterised in that reflective components (18-1, 20-1, 18-2, 20-2) and/or refractive components (16-1, 16-2) and/or diffractive components are provided as
10 the optical components defining light paths.
41. An illuminator according to any one of claims 25 to 40, characterised in that mirrors (18-1, 20-1, 18-2, 20-2) and/or lenses (16-1, 16-2) and/or diaphragms are
15 provided as the optical components defining light paths.
42. An illuminator according to any one of claims 25 to 41, characterised in that the light paths take the
20 form, at least between the light source and the light path selector unit, of free radiation light paths (14-1, 14-2; 14-1, 14-2, 14-3) which are not bound to a medium which defines the light path.
- 25 43. An illuminator according to any one of claims 25 to 42, characterised in that the light output or the light outputs are formed on the basis of a (respective) light guide (34; 34-1, 34-2).
- 30 44. An illuminator according to any one of claims 25 to 43, characterised in that the control unit controls the light conditioning arrangement or light conditioning arrangements.